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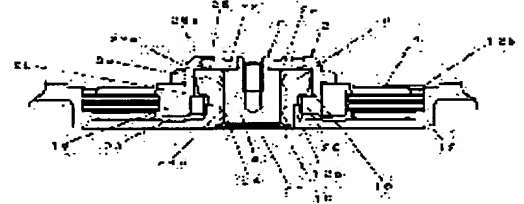
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(54) SPINDLE MOTOR AND DISC DRIVE USING THE SAME

(57)Abstract:

PROBLEM TO BE SOLVED: To avoid metal powder produced by the contact of a fall-off preventive part and to enable thickness reduction and cost reduction while required rotation precision is obtained.

SOLUTION: A thrust bearing part is formed between a top surface of a sleeve and a bottom surface of a hub, and a radial dynamic pressure bearing part is formed between the inner circumferential surface of the sleeve and an outer circumferential surface of a shaft. An annular flange protruding radially outward is formed on the outer circumferential surface of the sleeve, and an annular member harder than the sleeve at least in the surface portion is fixed to an inner circumferential surface of a cylindrical wall of a rotor. The flange and the annular member are engaged with each other to provide a fall-off preventive function for the rotor.



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CLAIMS

[Claim(s)]

[Claim 1] A shaft and the sleeve in which the through tube in which this shaft is inserted loosely free [rotation] was formed. It is the spindle motor equipped with Rota which has the cylinder wall which hangs from the periphery edge of the circular top plate with which this shaft was constituted by the revolving-shaft alignment in one, and this top plate. The upper limit side of said sleeve and the base of a top plate at least to either The dynamic pressure generating slot which gives the pressure which goes to the method of the inside of radial to said oil at the time of rotation of said Rota is prepared. The thrust-bearing section is constituted. Between the inner skin of said sleeve, and the peripheral face of a shaft Radial dynamic pressure bearing which carries out induction of the fluid dynamic pressure to said oil at the time of rotation of said Rota is constituted. To said sleeve The annular flange to which a peripheral face projects in the method of the outside of radial is prepared. To the inner skin of the cylinder wall of said Rota Because the annular member which projects in the method of the inside of radial fixes in the location corresponding to the lower part of this flange and this flange and this annular member engage with it Said annular member is a spindle motor with which it is characterized by constituting ***** of said Rota and the front face being hard from said sleeve at least.

[Claim 2] Said annular member is a spindle motor according to claim 1 characterized by being formed from ceramic material.

[Claim 3] Said annular member is a spindle motor according to claim 1 characterized by being formed from metal material and carrying out hardening processing of the front face.

[Claim 4] One edge of the through tube formed in said sleeve It is blocked by the lock out member. The upper limit side of said sleeve, and the base of the top plate of said Rota, In the peripheral face list of the inner skin of said sleeve, and said shaft, between the inside of said lock out member, and the end face of said shaft While a continuous minute gap is formed, in said minute gap It is held continuously, without oil breaking off over the whole. To said radial dynamic pressure bearing The herringbone groove it comes [herringbone] to connect the spiral groove of the pair which generates an equivalent pressure on parenchyma is prepared as a dynamic pressure generating slot. moreover, between the inside of said lock out member, and the end face of said shaft Bearing which has the pressure which goes to the method of the inside of radial [which is generated in said thrust bearing section], and the pressure balanced on parenchyma is formed. Said Rota It is the spindle motor according to claim 1 to 3 characterized by energizing said Rota magnetically in the direction which counters in this surfacing direction and the direction of an axis while having risen to surface by collaboration with said thrust bearing section and this bearing.

[Claim 5] The peripheral face of said flange and the inner skin of the cylinder wall of said Rota have countered radial through a clearance. To the peripheral face of said flange While a taper side is established so that an outer diameter may reduce the diameter, and said oil forms a meniscus and is held between this taper side and the inner skin of said cylinder wall as it separates from the top plate of said Rota Between the top face of said annular member, and the inferior surface of tongue of said flange The spindle motor according to claim 1 to 4 characterized by forming the **** minute gap rather than the minimum clearance dimension of the radial gap formed between the taper side of said flange peripheral face, and the inner skin of the cylinder wall of said Rota, and functioning as a labyrinth seal.

[Claim 6] It is the disk driving gear which is a disk driving gear which has the spindle motor which is fixed to the interior of housing and this housing, and is made to rotate this record medium in the disk driving gear with which it is equipped with the disc-like record medium which can record information, and an information access means for writing in or reading information to the necessary location of this record medium, and is characterized by for said spindle motor to be a spindle motor indicated to claim 1 thru/or 5.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the spindle motor equipped with the hydrodynamic bearing, and the disk driving gear using this spindle motor.

[0002]

[Description of the Prior Art] In order to support a shaft and a sleeve as bearing of the spindle motor used from the former in the disk driving gear which drives record media, such as a hard disk, enabling free relative rotation, the hydrodynamic bearing using the fluid pressure of lubrication fluids, such as oil made to intervene among both, is proposed variously.

[0003] The applicant of this application sets about the spindle motor which uses such a hydrodynamic bearing to Japanese Patent Application No. No. (JP,2000-113582,A) 296156 [ten to] etc. Between the peripheral faces of Shaft d and the inner skin of Sleeve b which constituted the thrust bearing section c for generating the surfacing force of Rota a between the base of Rota a, and the upper limit side of Sleeve b, and were prepared in Rota a in one as shown in drawing 1 The spindle motor which constituted the radial bearing sections e and e for acting on alignment and the falling prevention of Rota a was proposed.

[0004]

[Problem(s) to be Solved by the Invention] It has the merit of becoming possible to thin-shape-ize while it simplifies and low-cost-izes structure of a motor, without reducing bearing rigidity remarkably, since the above-mentioned spindle motor does not require the thrust plate which constitutes the thrust bearing section like the conventional hydrodynamic bearing. However, application to small devices, such as a Personal Digital Assistant, is started, and, as for the disk driving gear with which such a spindle motor is used, the demand of the further thin-shape-izing is increasing. In addition, the further low cost-ization of the spindle motor itself has also come to be required from the flow of low-pricing of a disk driving gear.

[0005] On the other hand, with the spindle motor illustrated to above-mentioned drawing 1 , the edge of the radial bearing sections e and e was exposed into air because establish the free passage way f constituted from slots f2 and f3 by through tube f1 list in Sleeve b, and incorporate the open air to bearing circles, namely, air enables circulation of the outside of bearing circles. This is a configuration for discharging the air which the part from which the internal pressure of the oil currently held between each bearing will be in the negative pressure condition below atmospheric pressure according to a pumping operation of the dynamic pressure generating slot formed in each bearing arose, and melted in oil by the time of a filling-with-oil activity, the contamination of a dynamic pressure generating slot, etc. to the bearing exterior.

[0006] if the air which melted in oil air bubbles-ize and it appear, an air bubbles carry out cubical expansion by low voltage-ization of a temperature rise or an external environment, and the problem which influence the problem which influence the endurance and the dependability of a spindle motor of make oil leak to the bearing exterior, or the rotation precision of a spindle motor call generating of vibration and the aggravation of NRRO (non-repeatability deflection component) by a dynamic pressure generating slot contact an air bubbles will occur.

[0007] Although cutting implements, such as a drill, are used for formation of the free passage way f for such cellular discharge, if the reinforcement of a cutting cutting edge is taken into consideration, the through tube f1 and slots f2 and f3 which constitute the free passage way f can seldom be formed into a small dimension. therefore, the above-mentioned free passage way f -- forming -- in addition -- and -- in order to maintain the bearing rigidity of the radial bearing sections e and e -- the dimension of the direction of an axis of Shaft d and Sleeve b -- more than a predetermined dimension -- not setting up -- it did not obtain but there was a limitation in thin shape-ization of a spindle motor naturally.

[0008] Moreover, by forming slots f2 and f3 in the through tube f1 list which constitutes the free passage way f at Sleeve b, while the part structure is complicated, the processing man day of Sleeve b will increase and it will

become an increase of cost.

[0009] Furthermore, the edge of the opposite side is equipped with the ring member g which constitutes ***** of Rota a with Rota a of Shaft d. That is, it becomes a slot and the factor which checks thin shape-ization of a spindle motor since the ring member g will lap with the same shaft in the direction of an axis and it will be arranged at the through tube list which constitutes the thrust-bearing section c, the radial bearing sections e and e, and the free passage way f.

[0010] In order to prevent this, when ***** of Rota a is constituted in the exterior of bearing, ***** will exist in air (henceforth an air drain).

[0011] However, if it is the case where ***** is constituted in bearing, since the metal powder generated even if contact arises in ***** by an external vibration or impression of an impact at the time of rotation is caught by the oil held at bearing, it cannot disperse in the exterior of a spindle motor. On the other hand, when ***** is constituted by the air drain, the metal powder generated in ***** will disperse to the exterior of a spindle motor easily.

[0012] In the disk driving gear which drives record media, such as a hard disk, in order to shorten a seek time, the recording surfaces and heads of a disk are few, or estrange only a clearance 1 micrometer or less, therefore even if they are minute dust, they are bit between a head and a recording surface, and become the cause which causes the so-called head crash. In the case of the spindle motor used for the bottom of such an environment, scattering of such a metal powder poses a big problem on quality.

[0013] When the rotation flank material and quiescence flank material which constitute ***** are especially formed from the metal of the same kind, generating of the metal powder at the time of contact becomes more remarkable.

[0014] This invention aims at offering the disk driving gear which used for the thin shape-ized list the spindle motor in which low-cost-izing is possible, and this spindle motor, though generating of the metal powder by contact of ***** can be prevented and a desired rotation precision is acquired.

[0015]

[Means for Solving the Problem] The sleeve in which the through tube inserted by invention according to claim 1 free [rotation of a shaft and this shaft] was formed, It is the spindle motor equipped with Rota which has the cylinder wall which hangs from the periphery edge of the circular top plate with which this shaft was constituted by the revolving-shaft alignment in one, and this top plate. The upper limit side of said sleeve and the base of a top plate at least to either The dynamic pressure generating slot which gives the pressure which goes to the method of the inside of radial to said oil at the time of rotation of said Rota is prepared. The thrust-bearing section is constituted. Between the inner skin of said sleeve, and the peripheral face of a shaft Radial dynamic pressure bearing which carries out induction of the fluid dynamic pressure to said oil at the time of rotation of said Rota is constituted. To said sleeve The annular flange to which a peripheral face projects in the method of the outside of radial is prepared. To the inner skin of the cylinder wall of said Rota Because the annular member which projects in the method of the inside of radial fixes in the location corresponding to the lower part of this flange and this flange and this annular member engage with it ***** of said Rota is constituted. Said annular member While the front face acquires a desired rotation precision rather than said sleeve at least because it is hard and realizing thin shape-ization of a motor It becomes possible to prevent generating of the metal powder by both contact as much as possible by the thing of the annular member which constitutes ***** with a sleeve for which a surface degree of hardness is changed at least.

[0016] Since said annular member is formed from ceramic material, invention according to claim 2 becomes possible [preventing generating of a metal powder certainly], without making a production process increase.

[0017] Since said annular member is formed from metal material and hardening processing of the front face is carried out, while invention according to claim 3 becomes possible [forming the annular member itself easily], it becomes possible [preventing generating of a metal powder certainly].

[0018] One edge of a through tube where invention according to claim 4 is formed in said sleeve It is blockaded by the lock out member. The upper limit side of said sleeve, and the base of the top plate of said Rota, In the peripheral face list of the inner skin of said sleeve, and said shaft, between the inside of said lock out member, and the end face of said shaft While a continuous minute gap is formed, in said minute gap It is held continuously, without oil breaking off over the whole. To said radial dynamic pressure bearing The herringbone groove it comes [herringbone] to connect the spiral groove of the pair which generates an equivalent pressure on parenchyma is prepared as a dynamic pressure generating slot. moreover, between the inside of said lock out member, and the end face of said shaft Bearing which has the pressure which goes to the method of the inside of radial [which is generated in said thrust bearing section], and the pressure balanced on parenchyma is formed. Said Rota While having risen to surface by collaboration with said thrust bearing section and this bearing, said Rota Since it is magnetically energized in the direction which counters in this surfacing

direction and the direction of an axis, the configuration of the free passage hole which opens the interior of bearing for free passage in the open air is not required, but it becomes possible to simplify structure and to achieve low cost-ization of a motor.

[0019] In invention according to claim 5, the peripheral face of said flange and the inner skin of the cylinder wall of said Rota have countered radial through a clearance. To the peripheral face of said flange While a taper side is established so that an outer diameter may reduce the diameter, and said oil forms a meniscus and is held between this taper side and the inner skin of said cylinder wall as it separates from the top plate of said Rota Between the top face of said annular member, and the inferior surface of tongue of said flange Since the **** minute gap is formed rather than the minimum clearance dimension of the radial gap formed between the taper of said flange peripheral face, and the inner skin of the cylinder wall of said Rota and it functions as a labyrinth seal It becomes possible to prevent not only the outflow of oil but **** to the motor exterior of the oil mist containing the oil produced by evaporation.

[0020] In the disk driving gear with which it is equipped with the disc-like record medium with which invention of claim 6 can record information Housing and the spindle motor which is fixed to the interior of this housing and made to rotate this record medium, It is the disk driving gear which has an information access means for writing in or reading information to the necessary location of this record medium. Said spindle motor Since it is the spindle motor indicated to claim 1 thru/or 6, it becomes possible to have excelled in dependability with low cost and a thin shape. Moreover, although the spindle motor of this invention is suitably usable in the disk driving gear which drives the hard disk whose outer diameter is 1 inch from small and thin-shape-izing being possible, for example, it is not limited to this but becomes usable similarly in the disk driving gear which drives an attachment-and-detachment-type record medium, such as fixed [, such as a hard disk,] or CD-ROM, and DVD.

[0021]

[Embodiment of the Invention] Although the operation gestalt of the spindle motor concerning this invention and the disk driving gear using this spindle motor is hereafter explained with reference to drawing 2 thru/or drawing 4 , this invention is not limited to the example shown below.

[0022] In the block diagram 2 of a spindle motor (1) This spindle motor The rotor hub 2 which consists of approximate circle tabular upper wall section 2a (top plate) and cylindrical peripheral wall section 2b (cylinder wall) which hangs caudad from the periphery edge of this upper wall section 2a, Rota 6 where one edge is constituted from a shaft 4 by which outside attachment immobilization is carried out by the center section of upper wall section 2a of this rotor hub 2, The bell shape sleeve 8 supported for this shaft 4, enabling free rotation and the lower part of this sleeve 8 are blockaded, and the free edge side edge side of a shaft 4, the seal cap 10 (lock out member) which counters, and the bracket 12 with which body 12a by which a sleeve 8 is inner-**(ed) was formed in one are provided.

[0023] The Rota magnet 16 fixes so that it may have the configuration of the shape of **** centering on body 12a to the bracket 12, and the stator 14 which has two or more teeth which protrude on the method of the inside of radial in inner skin 12b of the peripheral wall which makes the shape of this bowl may be arranged and the peripheral face of peripheral wall section 2b of a rotor hub 2 may be countered through a gap from this stator 14 and the method of the inside of radial.

[0024] Between the end faces of a shaft 4 and the insides of a seal cap 10 which follow between the peripheral faces of a shaft 4 and the inner skin of a sleeve 8 following upper wall section 2a of a rotor hub 2, and this, a series of minute gaps are formed between the upper limit side of a sleeve 8, and the inferior surface of tongue of upper wall section 2a of a rotor hub 2. It is held continuously, without oil breaking off all over this minute gap, and the so-called hydrodynamic bearing of full philharmonic structure is constituted. In addition, an axial manner of support is behind explained in full detail in the configuration list of the bearing in this operation gestalt.

[0025] Annular flange 8a formed in the shape of an inclined plane was prepared in the upper limit section of the peripheral face of a sleeve 8 so that the diameter might be reduced as it protrudes on the method of the outside of radial and a peripheral face estranges from the upper limit side of a sleeve 8, and it has countered radial in the state of the inner skin of peripheral wall section 2a of a rotor hub 2, and non-contact.

[0026] The radial gap dimension of the gap specified between the inner skin of this peripheral wall section 2b and the peripheral face of flange 8a is formed in the shape of an inclined plane as the peripheral face of flange 8a is the above, and it is increased gradually in the shape of a taper toward the direction lower part of an axis (the direction of a point of peripheral wall section 2b). That is, the inner skin of this peripheral wall section 2b and the peripheral face of flange 8a collaborate, and the taper seal section 18 is constituted. Between the upper limit side of a sleeve 8, and the inferior surfaces of tongue of upper wall section 2a of a rotor hub 2, The oil held in a series of minute gaps formed between the end faces of a shaft 4 and the insides of a seal cap 10

which follow between the peripheral faces of a shaft 4 and the inner skin of a sleeve 8 following upper wall section 2a of a rotor hub 2 and this Only in this taper seal section 18, the surface tension of oil and an outside atmospheric pressure balance, and the interface of oil and air is formed in the shape of a meniscus.

[0027] The taper seal section 18 has the movable formation location of an interface suitably according to the amount of oil which functions as an oil reservoir and is held in the taper seal section 18. Therefore, while the oil held in the taper seal section 18 is supplied to bearing with reduction of the amount of oil maintenance, the oil of the part to which the volume increased by thermal expansion etc. is held in this taper seal section 18.

[0028] Thus, a taper-like gap is formed between the peripheral face of flange 8a of a sleeve 8, and the inner skin of peripheral wall section 2b of a rotor hub 2, and with constituting the taper seal section 18 using surface tension, while the taper seal section 18 serves as a major diameter from bearing, it can consider as size in [the direction dimension of an axis of the taper seal section 18] comparison. Therefore, the volume in the taper seal section 18 increases, and imitation becomes possible enough also to the thermal expansion of the oil held so much at the hydrodynamic bearing of full philharmonic structure.

[0029] To the point, the annular ***** ring 20 (annular member) has fixed with means, such as adhesion, rather than the taper seal section 18 of peripheral wall section 2b. This ***** ring 20 is fitting in each other in the state of non-contact to the lower part of flange 8a in the lower limit section of the peripheral face of a sleeve 8, and the ***** structure of Rota 6 over a sleeve 8 is constituted.

[0030] Even when the ***** ring 20 was formed from hard ceramic material at this time, an external vibration and an external impact are impressed to a spindle motor and contact to the ***** ring 20 and a sleeve 8 occurs at the time of rotation of Rota 6, generating of a metal powder is prevented.

[0031] Moreover, it is possible to prevent generating of the metal powder by contact to a sleeve 8 also by replacing with this, forming the ***** ring 20 from metal material, such as for example, SUS material, and performing surface preparation which makes the front face hard. As surface preparation in this case, nickel plating, DLC (diamond-like carbon) coating, or nitriding treatment is desirable.

[0032] in addition, the above -- in any case, it is possible to form the sleeve 8 formed with SUS material or a copper system ingredient and the ***** ring 20 from a dissimilar material.

[0033] thus, since it becomes possible to prevent generating of the metal powder by contact to the ***** ring 20 and a sleeve 8, it becomes possible to boil and prepare the configuration used as ***** of Rota 6 in the peripheral face side of a sleeve 8, i.e., the inside of an air drain. Therefore, alignment arrangement of the radial bearing section and ***** structure of a pair which are explained in full detail behind is not carried out on the same line in the direction of an axis. Therefore, it becomes possible to utilize the overall length of a shaft 4 effectively as bearing, and thin shape-ization of the further motor is realized, maintaining bearing rigidity.

[0034] The top face of the ***** ring 20 has countered through the gap of the direction of an axis which follows the inferior surface of tongue and the taper seal section 18 of flange 8a, and has a ***** clearance dimension rather than the minimum clearance dimension of the radial gap of the taper seal section 18.

[0035] By setting up as small as possible the gap dimension of the minute gap of the direction of an axis specified between the top face of the ***** ring 20, and the inferior surface of tongue of flange 8a A difference with the rate of flow of the air in the radial gap specified in the rate of flow and the taper seal section 18 of air in the minute gap of this direction of an axis at the time of rotation of a spindle motor becomes large. Effluent resistivity to the exterior of the steam produced when oil evaporated is enlarged, and vapor pressure [/ near the interface of oil] is kept high, and it functions as a labyrinth seal so that evapotranspiration of the further oil may be prevented.

[0036] Thus, the outflow of the oil as a liquid is not only prevented, but it becomes possible by allotting a labyrinth seal succeeding the taper seal section 18 to also prevent the outflow to the motor exterior of the oil mist generated because oil evaporates by the rise of the external-environment temperature of a motor etc. Therefore, the fall of the amount of oil maintenance can be prevented, the bearing engine performance stabilized over the long period of time can be maintained, and it can consider as bearing with high endurance and dependability.

[0037] (2) Herringbone groove 22a of the shape of a character of abbreviation “**” constituted by connecting the spiral slot of the pair which inclines in the direction which carries out induction of the fluid dynamic pressure to oil at the time of rotation of Rota 6, and which conflicts to a hand of cut is formed in the upper limit side side of a sleeve 8, and the up radial dynamic pressure bearing 22 is constituted between the peripheral faces of a shaft 4 by the inner skin of the configuration sleeve 8 of bearing.

[0038] Moreover, herringbone groove 24a of the shape of a character of abbreviation “**” constituted by connecting the spiral slot of the pair which inclines in the direction which carries out induction of the fluid dynamic pressure to oil at the time of rotation of Rota 6, and which conflicts to a hand of cut is formed in the free edge side of a shaft 4, and the lower radial dynamic pressure bearing 24 is constituted by the inner skin of

a sleeve 8 between the peripheral faces of a shaft 4.

[0039] In addition, it is set up so that each spiral groove may generate the equivalent pumping force substantially, and a slot item called the tilt angle or the flute width, and the depth to a dimension and a hand of cut of the direction of an axis may become the same, i.e., the herringbone grooves 22a and 24a formed in the upper part and the lower radial dynamic pressure bearings 22 and 24 are set up so that each spiral groove may become axial symmetry to the connection section. Therefore, in the upper part and the lower radial dynamic pressure bearings 22 and 24, the maximum dynamic pressure appears in the direction center section of an axis of bearing (connection section of each spiral groove), the pumping by each spiral groove becomes imbalanced to the direction of one of the directions of an axis, and a flow of the direction of an axis does not occur in oil.

[0040] Furthermore, spiral groove 26a of the pump in which carries out induction of the pressure which goes to the method of the inside of radial (shaft 4 side) to oil at the time of rotation of Rota 6 is formed in the upper limit side of a sleeve 8, and the thrust bearing section 26 is constituted between the inferior surfaces of tongue of upper wall section 2a of a rotor hub 2.

[0041] Moreover, between the free edge side edge side of a shaft 4, and the inside of a seal cap 10, the static pressure bearing 28 using the internal pressure of the oil raised by spiral groove 26a of the thrust-bearing section 26 is constituted as explained in full detail behind.

[0042] (3) Explain the axial manner of support by each bearing constituted as the axial manner-of-support above in full detail with reference to drawing 3. Drawing 3 In addition, between the upper limit side of a sleeve 8, and the inferior surfaces of tongue of upper wall section 2a of a rotor hub 2, The relative relation of the pressure distribution of the oil held all over the minute gap formed between the end faces of a shaft 4 and the insides of a seal cap 10 which follow between the peripheral faces of a shaft 4 and the inner skin of a sleeve 8 following upper wall section 2a of a rotor hub 2, and this Although it is the pressure distribution chart which developed for every bearing and was shown typically, since the pressure distribution of a spindle motor serve as axial symmetry, the pressure distribution of the field which serves as the opposite side in the longitudinal section of a spindle motor are omitted to the revolving-shaft alignment shown with an alternate long and short dash line in drawing 3. Moreover, the number shown in drawing 3 is the same as the number attached to each bearing in drawing 2.

[0043] In the upper part and the lower radial hydrodynamic bearings 22 and 24, with rotation of Rota 6, the pumping force by the herringbone grooves 22a and 24a increases, and fluid dynamic pressure arises. As shown in drawing 3, the pressure distribution in the upper part and the lower radial dynamic pressure bearings 22 and 24 increase rapidly, and serve as the maximum from the both-ends side of the herringbone grooves 22a and 24a in the connection section of each spiral groove. Using the fluid dynamic pressure besides generated in the section and the lower radial dynamic pressure bearings 22 and 24, axial support is carried out from the direction of axis vertical section, and the shaft 4 is bearing an alignment operation and the restoration operation which receives falling of a shaft 4.

[0044] In the thrust-bearing section 26, induction of the pressure which goes to the method of the inside of radial by spiral groove 26a of pump in at oil is carried out with rotation of Rota 6. It is urged to a flow of oil, the internal pressure of oil is raised by the pressure which goes to the method of the inside of radial [this], and the fluid dynamic pressure which acts in the surfacing direction of Rota 6 occurs. In addition, the fluid dynamic pressure by which induction is carried out in the thrust-bearing section 26 is extent which does not increase rapidly like the upper part and the lower radial dynamic pressure bearings 22 and 24, and exceeds atmospheric pressure a little at the maximum, as shown in drawing 3.

[0045] The oil currently held between the end faces of a shaft 4 and the insides of a seal cap 10 which follow between the peripheral faces of a shaft 4 and the inner skin of a sleeve 8 following upper wall section 2a of a rotor hub 2 and this with the pressure generated in the thrust-bearing section 26 The herringbone grooves 22a and 24a which will be in the condition of having been sealed on parenchyma in pressure, and are formed in the upper part and the lower radial dynamic pressure bearings 22 and 24 are made into a configuration symmetrical with the direction of an axis. By making dynamic pressure to generate into the condition of having balanced in the direction of an axis, induction of the flow of the direction of an axis is not carried out to oil as above-mentioned. The internal pressure of the oil held by this between the end faces of a shaft 4 and the insides of a seal cap 10 which follow between the peripheral face of a shaft 4 and the inner skin of a sleeve 8 and this balances with the internal pressure of the oil held at this thrust-bearing section, without receiving interference of the fluid dynamic pressure generated in the upper part and the lower radial dynamic pressure bearings 22 and 24. Therefore, the negative pressure which it becomes equivalent to the internal pressure of the oil held also in which field at the thrust bearing section 26, and internal pressure turns into below atmospheric pressure in the oil held all over these minute gaps does not occur as drawing 3 is shown. Therefore, the problem of the air bubbles resulting from negative pressure is solved.

[0046] As above-mentioned, the pressure generated in the thrust bearing section 26 is extent exceeding atmospheric pressure a little, and is difficult to fully surface Rota 6 only now. However, the internal pressure of the oil held at the static pressure bearing 28 constituted between the free edge side edge side of a shaft 4, and the inside of a seal cap 10 as above-mentioned Since it becomes a pressure equivalent to the internal pressure of the oil raised by the fluid dynamic pressure by which induction is carried out in the thrust bearing section 26, collaboration with the thrust bearing section 26 and the static pressure bearing 28 enables it to fully surface Rota 6.

[0047] In addition, the annular thrust yoke 30 which becomes an opposite location with the Rota magnet 16 of a bracket 12 from ferromagnetic material is arranged so that it may be illustrated in drawing 2 . By generating the magnetic-attraction force of the direction of an axis between the Rota magnet 16 and a thrust yoke 30 It was made to balance with ***** of Rota 6 generated in the thrust-bearing section 26 and the static pressure bearing 28, support of the thrust direction of Rota 6 was stabilized, and generating of fault surfacing to which Rota 6 surfaces beyond the need is controlled. As for the magnetic energization to such Rota 6, it is possible to make it act also by making different the magnetic core of a stator 14 and the Rota magnet 16 in the direction of an axis.

[0048] (4) The internal configuration of the common disk driving gear 50 is shown in the block diagram 4 of a disk driving gear as a mimetic diagram. The interior of housing 51 forms clean space with little dust, dust, etc. to the degree of pole, and the spindle motor 52 with which it was equipped with the disc-like disk plate 53 which memorizes information is installed in the interior. In addition, inside housing 51, the head migration device 57 in which information is written to the disk plate 53 is arranged, and this head migration device 57 is constituted by the actuator section 54 which moves the head 56 which write the information on the disk plate 53, the arm 55 supporting this head, a head 56, and an arm 55 to the necessary location on the disk plate 53.

[0049] It becomes possible to become possible to prevent generating of the metal powder from a spindle motor 52, to avoid problems, such as a head crash, and to consider as a reliable disk driving gear by using the spindle motor illustrated in drawing 2 as a spindle motor 52 of such a disk driving gear 50.

[0050] Moreover, since the spindle motor 52 is able to constitute ***** of Rota in an air drain, although a desired rotation precision is acquired, low cost-ization is attained at the thin shape-ized list of the disk driving gear 50.

[0051] As mentioned above, although 1 operation gestalt of a disk driving gear was explained to the spindle motor list according to this invention, various deformation thru/or corrections is possible for this invention, without not being limited to this operation gestalt and deviating from the range of this invention.

[0052] for example , it be also possible to change to spiral groove 26a of the pump in type explained in the above-mentioned operation gestalt as a means form in the thrust bearing section to generate the pressure which act on the method of the inside of radial to oil , and to consider as the herringbone groove which have an imbalanced configuration in radial . In this case, the amount of imbalance of the pumping force between these spiral grooves serves as a pressure which acts on the method of the inside of radial to oil by setting up so that the pumping force by the spiral groove located in the method side of the outside of radial may exceed the pumping force by the spiral groove located in the method side of the inside of radial.

[0053] In addition, since the surfacing force given to Rota becomes higher than the surfacing force generated in a spiral groove when the above-mentioned herringbone groove is prepared in the thrust-bearing section, while the load bearing capacity by the thrust-bearing section improves, there are surfacing force generated in static pressure bearing and concern which fault surfacing of Rota generates conjointly. Therefore, it is necessary to control this by the magnetic energization force given to Rota.

[0054]

[Effect of the Invention] In the spindle motor of claim 1 of this invention, since generating of the metal powder by contact is prevented, it becomes possible to prepare the configuration used as ***** of Rota in an air drain, and radial dynamic pressure bearing and ***** do not overlap on the same line of the direction of an axis. Therefore, it becomes possible to realize thin shape-ization of a motor, acquiring a desired rotation precision.

[0055] In the spindle motor of claim 2 of this invention, it becomes possible to prevent generating of the metal powder by contact of ***** certainly, without increasing a production process.

[0056] It becomes possible to prevent generating of the air bubbles within oil.

[0057] In the spindle motor of claim 3 of this invention, while it is possible to produce ***** easily, it becomes possible to prevent generating of the metal powder by contact of ***** certainly.

[0058] In the spindle motor of claim 4 of this invention, it becomes possible to realize simplification of structure, and stabilization of the Rota support to coincidence.

[0059] In the spindle motor of claim 5 of this invention, it becomes possible to prevent more effectively the

outflow to the bearing exterior of oil itself and an oil mist.

[0060] In the disk driving gear of claim 6 of this invention, it becomes possible to have excelled in dependability with low cost and a thin shape.

[Translation done.]

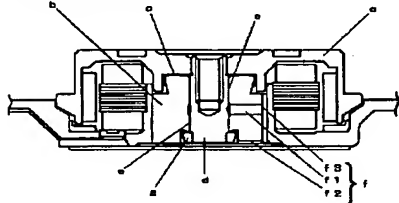
*** NOTICES ***

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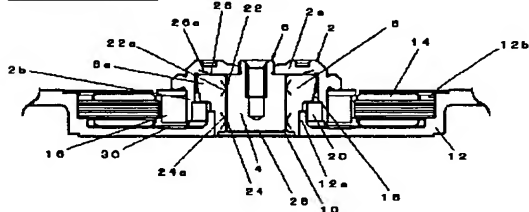
1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

DRAWINGS

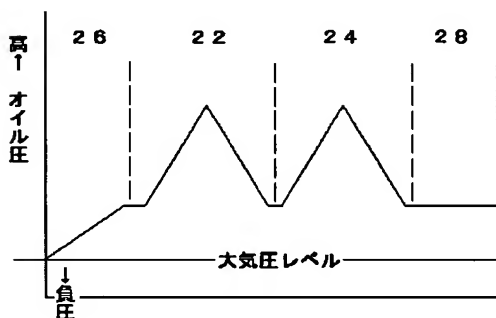
[Drawing 1]



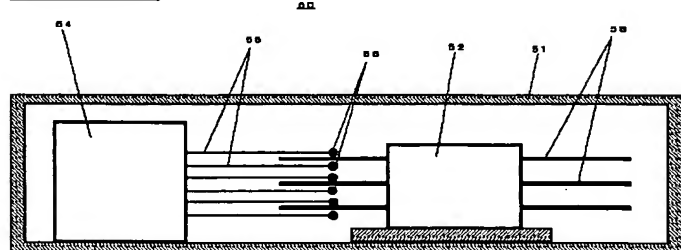
[Drawing 2]



[Drawing 3]
圧力分布図



[Drawing 4]



[Translation done.]